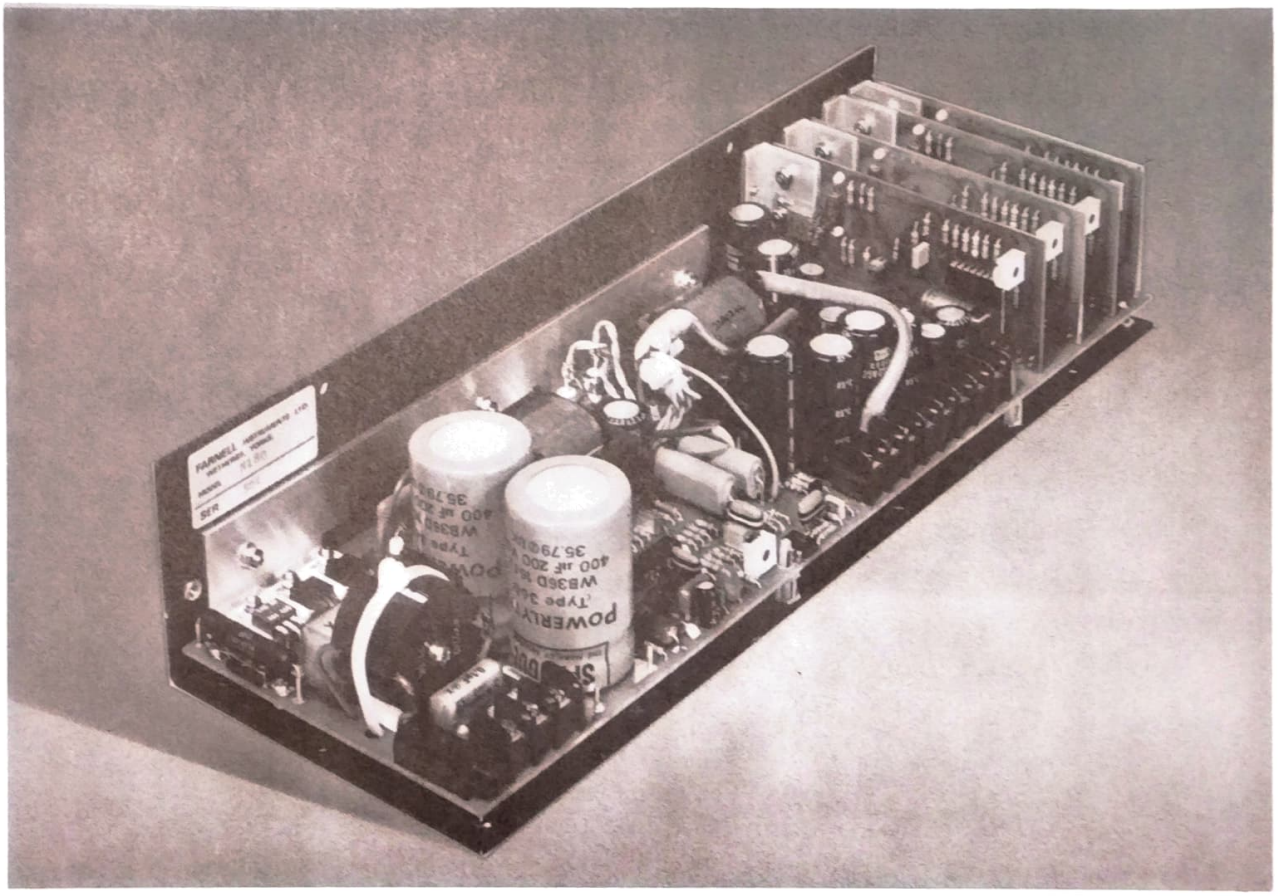
Provisional data

Farnell

multi-output power supplies–MOPS



● Switched-mode technique for compactness and high efficiency ● Open frame construction (optional cover) ● Standard models have five outputs: ±5V; ±12V and +24V d.c. ● Alternative outputs to order ● 160 and 180 watt units (other versions soon) ● Foldback current limit protection on all outputs ● Soft start limits in-rush current ● 18mS minimum hold-up time ● Convection cooled ● Simplified mounting in any plane ● R.F.I. suppression to BS800 and VDE 0875 curve N ● Design and construction in accordance with UL478 and BPO Technical Guides 2 and 26 (sections 1.3, 1.3.1 and 2.5.1 respectively) ● British design and manufacture ● Tailored versions and custom designs to order

Applications:

● Computers ● Logic systems ● Mini and micro computers ● Computer peripherals: terminals, floppy disc drives etc. ● Microprocessor systems ● Business machines

Farnell introduce MOPS (multi-output power supplies) in economy open frame packages for OEM use in microprocessor systems, computers and peripherals, and business machines.

Using switched-mode rather than linear techniques, MOPS are small, easily mounted and highly efficient. They run cooler than linear units and do not require fans. An optional cover is available.

160 watts (regulated) and 180 watts (semi-regulated) standard units with five outputs are currently in production and other models are in the late design stage. The standard outputs are +5V; ±12V and +24V d.c. but alternatives can be had to order.

Soft start circuitry limits in-rush current and at least 18 mS hold-up time is provided. R.F.I. suppression is to BS800 and VDE 0875 curve N. Designed and constructed in accordance with UL478 and BPO standards, MOPS are of British design and manufacture but will second source some North American and European models.

Farnell have nearly 25 years expertise in power supplies and almost a decade's experience in volume production of switched-mode units. With two superb production plants located at Wetherby (67,000 ft²) and Boroughbridge (23,000 ft²) plus its own transformer manufacturing unit at Bishop Auckland, Farnell are capable of high volume, contract work to DEF 0524 standards and regularly supply off-the-shelf models, tailored versions and custom designs to many internationally known companies. There are sales/service departments in Wetherby and Harpenden, subsidiary companies in France and Italy and a European distribution network exists to fully support the multi-national OEM production line.

Specification

Mains input 220 to 240V or 115 to 120V set by link on circuit board. 45 to 440Hz

Mains variation tolerated 220 - 20% to 240 + 10% (176 to 264V) or 115 - 20% to 120 + 10% (92 to 132V)

Outputs

	V nom.	I max.	N160R*	N180*
Output 1	+5V	20A	Regulated	Regulated
Output 2	+12V	5A	Regulated	Semi-regulated
Output 3	-12V	5A	Regulated	Semi-regulated
Output 4	+24V	2A	Regulated	Semi-regulated
Output 5	-5V	1A	Regulated	Semi-regulated

* 160 watts total max. power
* 180 watts total max. power

Voltage adjustment Output 1: 4.75V to 5.25V
Outputs 2-5: +5% approx. (N160R)
Note: Model N160R has adjustment pots. on all outputs. Only output 1 can be adjusted on N180 and outputs 2-5 will vary in proportion

Ripple and noise

N160R model	Less than 50mV pk-pk all outputs (Δf = 30MHz)
N180 model	2% max. pk-pk 40mV max. r.m.s.

Temperature coefficient

N160R model	+0.02% per °C typical, all outputs
N180 model	Output 1: +0.02% per °C typical Outputs 2-5: +0.05% per °C typical

Operating ambient temperature range 0°C to +50°C for full output current rating. Convection cooled. No additional heatsink needed

Maximum operating ambient temperature All outputs and total maximum power output derate linearly from I max. and Po max. to half I max. and half Po max. respectively at 70°C

Output voltage regulation

N160R model	±1% max. deviation (including sum effect of line, load and cross regulation)
N180 model	
Line regulation	All outputs: 0.2% max. deviation for mains variation of 198 to 264V or 103 to 132V
Load regulation	Output 1: ±1% max. deviation Output 2: ±3% max. deviation Output 3: ±2% max. deviation Output 4: ±2% max. deviation Output 5: ±2.5% max. deviation (for ±40% load change from 60% I max. on considered output only)
Cross regulation (measured output set at 20% max. rated load)	Output 1: ±0.5% max. deviation (for ±25% change from 75% I max. on any output) Outputs 2-5: ±1.5% max. deviation (for ±25% change from 75% I max. on output 1) ±0.5% max. deviation (for ±25% change from 75% I max. on any output except 1)

Switch on surge Soft start limited to 16A max. peak current

Insulation Unit isolation barriers (input to output) including layout and wiring are designed to meet a test of: 4kV r.m.s. for 1 minute input to output (i.e. 2kV r.m.s. input to earth, 2kV r.m.s. output to earth)
Appropriate tests applied to all relevant components to ensure compliance with BS3535 clause 17B and CEE15 clause 17c.
The complete unit is tested at 2.1kV d.c. for 1 minute between a.c. input and d.c. output with output terminals and earth connected together. Tested to 500V d.c. for 1 minute, output to earth

Storage temperature range -25°C to +85°C

Hold-up time 18mS minimum. Output will be maintained for the duration of a missing half mains cycle at maximum output power and 220V -10% or 115V -10% mains input

Safety specifications Designed and manufactured in accordance with UL478 and BPO Technical Guides 2 and 26 (sections 1.3, 1.3.1 and 2.5.1 respectively)

Protection
Overload: Self resetting foldback current limiting on all outputs (N160R) and on output 1 only on N180 model. Overall power output limited to approx. 120% of full rated output
Overvoltage: Available as standard on all 5 outputs (N160R)
5V outputs - operates at 5.8 V min. 7V max.
12V outputs - operates at 13V min. 16V max.
24V output - operates at 26V min. 30V max.
Model N180 has overvoltage protection on output 1 only

Radio frequency interference Units comply with the conducted interference requirements of VDE 0875 curve N and BS800

Efficiency N180 80% typical, N160R 70% typical

Dimensions/weight

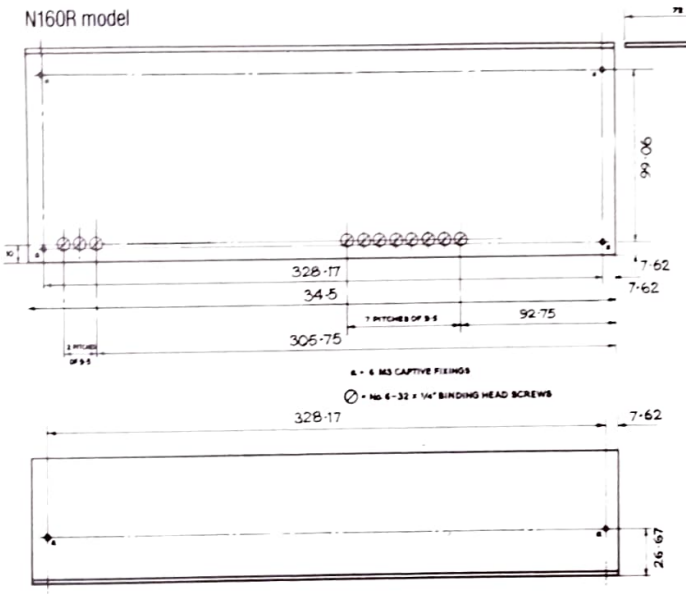
	N160R	N180	
Height	72mm	72mm	
Width	121.6mm	121.6mm	±0.5mm
Depth	345mm	266.5mm	
Weight	2.0 kg	1.4 kg	

Cover Optionally available

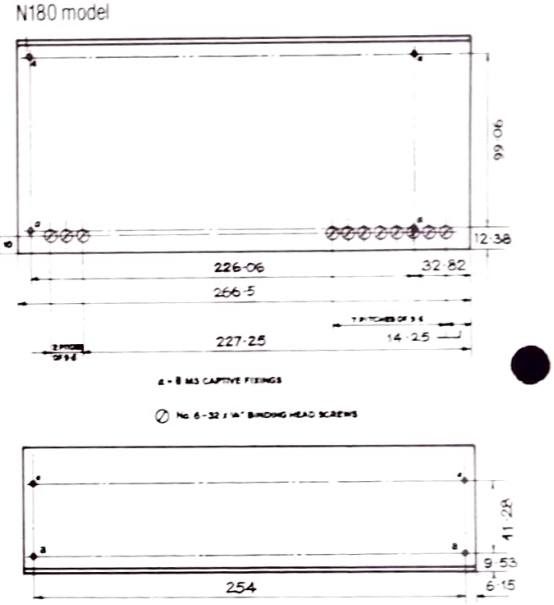
Connections Slotted screw terminals on barrier strips. 3 way barrier strip for supply input. Separate barrier strip for outputs

Mechanical details

N160R model



N180 model



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We reserve the right to amend specifications without notification.

OPERATING INSTRUCTIONS FOR

MOPS-OPEN FRAME MULTI-OUTPUT POWER SUPPLIES N180 & N160R

INTRODUCTION

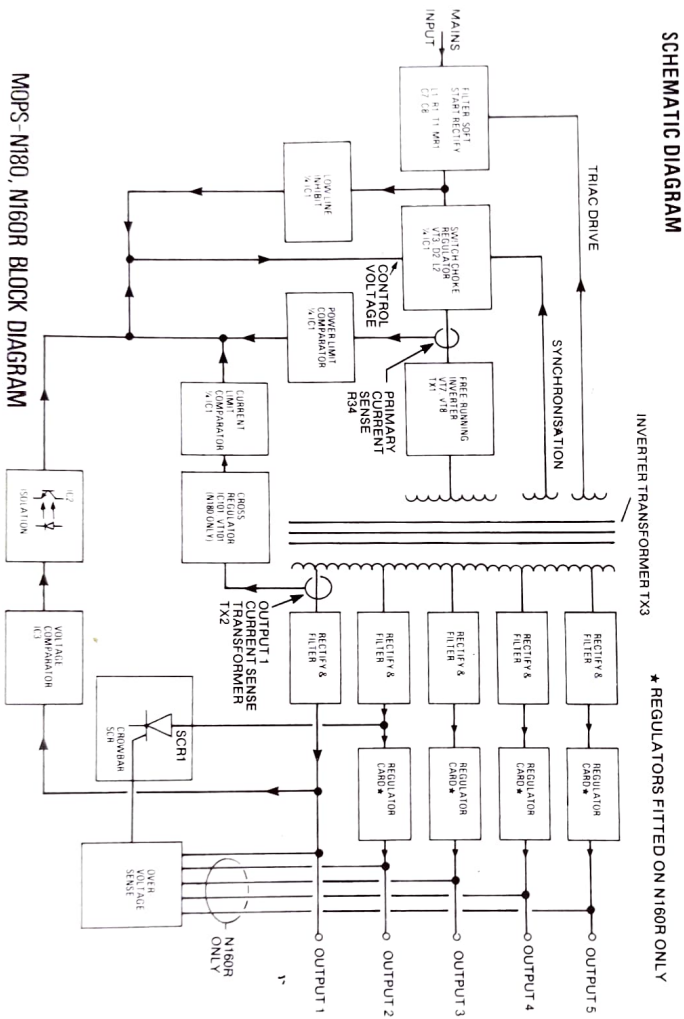
The Farnell MOPS range of multiple output switching power supplies provide the microprocessor user with an economic and efficient power source for his whole equipment. A single unit can provide five d.c. output voltages which are suitable for powering peripheral display, storage and input devices as well as the processor and memory.

This instruction sheet describes units based on the N180 and N160R systems which can deliver 180 watts and 160 watts total output power respectively. The N160R has all outputs fully regulated and the N180 has one fully regulated output with the others semi-regulated.

The standard outputs are +5V, +12V, -12V, +24V and -5V but many other combinations of voltage to suit particular applications can be manufactured to special order. These units are of open frame construction for incorporation inside other equipment and an optional cover is available.

The units may be operated from a.c. supply voltages of 115V and 230V nominal and are designed to meet several international specifications - UL478, BS800, VDE0875, CEE15.

SCHEMATIC DIAGRAM



★ REGULATORS FITTED ON N160R ONLY

MOPS-N180, N160R BLOCK DIAGRAM

SPECIFICATION

VARIATIONS FROM THIS SPECIFICATION FOR NON-STANDARD UNITS ARE INDICATED ON THE REVERSE OF THIS SHEET. ALL VALUES SPECIFIED FOR AN AMBIENT TEMPERATURE OF 25°C UNLESS OTHERWISE INDICATED.

Mains input 176 to 264V a.c. r.m.s.–230V tap
92 to 132V a.c. r.m.s.–115V tap. Selected by link on circuit board. Frequency 45 to 440Hz . 250 to 370V d.c. on 230V tap only.

Input current (at full load, typical)

	115V	220V	240V
R.M.S.	3.2A	1.8A	1.68A
MEAN	1.44A	750mA	690mA
REPETITIVE PEAK	9.6A	6.5A	5.8A

Switch on surge 16A max. peak current

Standard outputs (N180/F4100 and N160R/F4101 only) If unit is non standard refer to reverse of this sheet for output voltages and currents.

	Voltage (nominal)	Current (maximum)
Output 1	+5V	20A
Output 2	+12V	5A
Output 3	—12V	5A
Output 4	+24V	2A
Output 5	—5V	1A

Maximum output power N180 unit - 180 watts total. N160R-unit - 160 watts total. Note: it is necessary to derate the maximum current taken from one or more of the outputs to restrict the output power to the above figures.

Output voltage adjustment N160R - each output individually adjustable by ±5% from nominal. Factory preset to within 0.5% of specified nominal. **N180** - output 1 adjustable ±5%. Other outputs vary in proportion as output 1 adjusted. With output 1 set to 5.00V and all outputs loaded at 50% of maximum rated current the other outputs will be within 5% of the stated nominal.

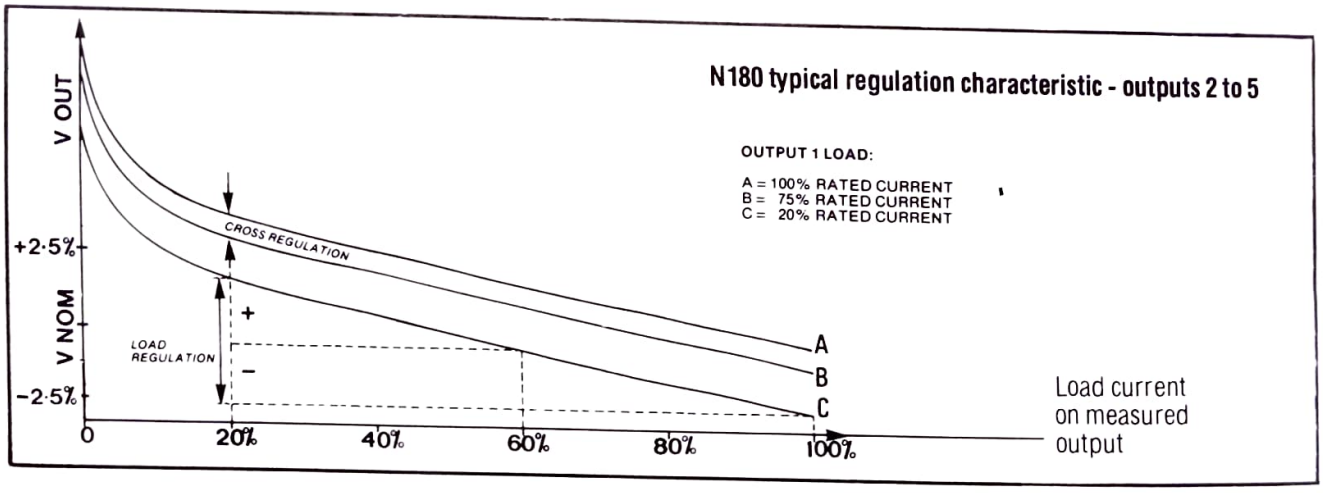
Output voltage regulation N160R - each output 1% maximum total change in voltage for, a zero to full load change on the measured output, the worst case change of load on the other outputs, and a line change of 176 to 264V or 92 to 132V

N180

LINE REGULATION: Each output 0.2% maximum change for a line change of 176 to 264V or 92 to 132V.

LOAD REGULATION:
Output 1 ±1% max. change
Output 2 ±3% max. change
Outputs 3 to 5 ±2.5% max. change.
for a ±40% load change from 60% Imax. (i.e. from 60% to 20% or 100% max. rated load) on the measured output. All other outputs at 20% max. rated load.

CROSS REGULATION:
All outputs: ±0.5% max. change for a ±25% load change from 75% Imax. on any one of outputs 2 to 5. Other outputs set at 20% max. rated load.
Outputs 2 to 5: ±1.5% max. change for a ±25% load change from 75% Imax. on output 1. Other outputs set at 20% max. rated load.



Ripple and noise (with unit delivering max. output power. Δf=30MHz). N160R - not greater than 75mV pk-pk; 20mV r.m.s. N180 - not greater than 2% Vout pk-pk; 0.5% Vout r.m.s.

Temperature coefficient (typical) N160R - All outputs: ±0.02% per °C N180 - Output 1: ±0.02% per °C. Outputs 2 to 5: ±0.05% per °C

Output hold-up time All outputs will be maintained for the duration of a missing mains half cycle (18ms from last mains peak) at nominal output voltage, maximum output power and 220V-10% or 115V-10% mains input. At higher input voltages and lower output power the hold-up time is increased as shown in the graph below:

Protection OVERLOAD: Self resetting foldback current limit set to approximately 115% of rated output current. N160R - all outputs protected. N180 - current limit on output 1 only. Overall power limit at approximately 120% of rated output power. OVERVOLTAGE: N160R - protection provided on each output. N180 - protection provided on output 1.

5V outputs - operates at 5.8V min., 7V max.
12V outputs - operates at 13V min., 16V max.
24V outputs - operates at 26V min., 30V max.

An overvoltage shuts down all outputs. Reset by interrupting the mains supply. FUSE: The mains input is fused (fuse type 20mm 6.3A T HRC)

Efficiency (at max. output power) N180 - 80% typical N160R - 70% typical

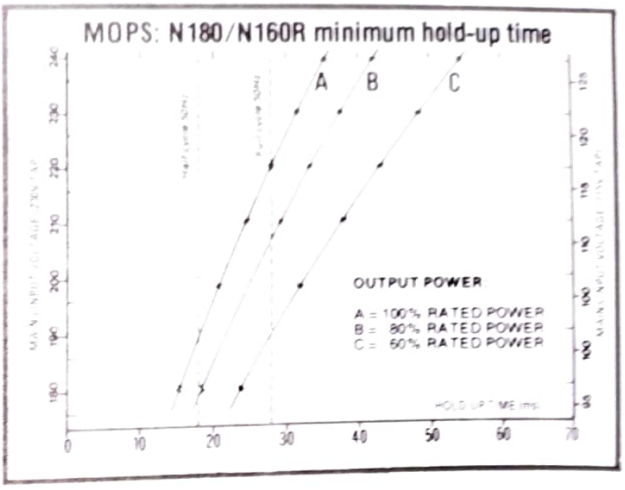
Operating ambient temperature range 0°C to 70°C. Derate linearly each output current and the total output power from max. at 50°C to half these values at 70°C

Storage temperature range - 25°C to 85°C

Radio Frequency Interference The units comply with the conducted interference requirements of VDE0875 curve N and BS800.

Insulation Unit input to output isolation barriers, including layout and wiring, are designed to meet a test of 4kV a.c. r.m.s. for one minute (i.e. 2kV r.m.s. input to earth, 2kV r.m.s. output to earth). Tests are applied to relevant components to ensure compliance with BS3535 clause 17b and CEE15 clause 17c. The complete unit is tested at 2.1kV d.c. for 1 minute between a.c. input and d.c. outputs, with output terminals connected to earth. Tested at 500V d.c. for one minute between output and earth.

Safety specifications Designed and manufactured in accordance with UL478 and BPO Technical Guides 2 and 26 (sections 1.3, 1.3.1 and 2.5.1 respectively).



Cover Optional. Available to order

Connections Slotted screw terminals on barrier strip. Three way barrier strip for supply input. Separate barrier strip for outputs (See drawing).

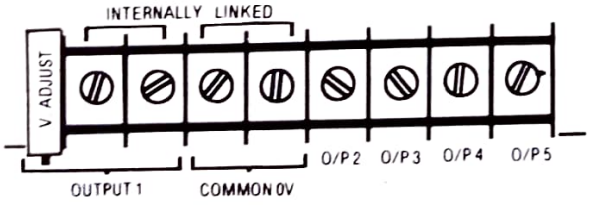
OPERATING INSTRUCTIONS

Warning: Hazardous voltages exist at many points within the unit. It is intended that this power supply be built into the users's equipment and that he provides protection against accidental contact. Where this cannot be done a cover should be fitted which is available to order from Farnell Instruments Ltd. DISCONNECT THE MAINS INPUT SUPPLY BEFORE TOUCHING THE UNIT. If the unit requires servicing it is recommended that it be returned to the manufacturer.

Mains input. The mains input terminals are on the 3-way terminal block at the edge of the circuit board and are marked L (live), N (neutral) and E (earth). The unit as supplied will operate from a 220 to 240V a.c. supply. For operation from 115 to 120V a.c. supplies a link should be fitted between the circuit board pins marked appropriately, adjacent to the mains input terminals.

NOTE: The link should only be fitted for low input voltage operation.

Output connections The output connections are on the 8-way terminal block, arranged as shown below:-



The Common and Output 1 terminals are duplicated so that the current may be shared between them.

The output voltages and maximum currents are indicated in the specification (reverse of sheet for non-standard units) but it is necessary to derate the maximum current taken from one or more of the outputs to restrict the total load to the power rating of the unit.

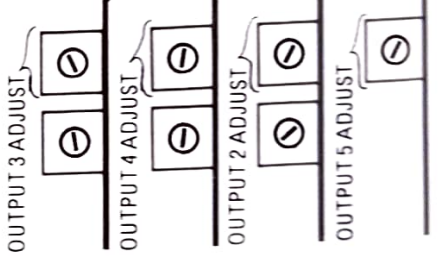
The N180 unit requires a minimum load on each output of 20% I max for the output voltages to remain within specification although the unit may be operated at lighter loads than this.

Output voltage adjustment Output 1 may be varied ±5% from nominal by adjustment of the multiturn potentiometer indicated on the diagram.

On the N180 unit this will cause a proportional change in voltage on the other outputs.

On the N160R all the outputs are fully regulated and outputs 2 to 5 may be individually varied ±5% from nominal by adjustment of the potentiometer on the regulator cards. indicated below:-

N160R unit only



NOTE: Output voltages and regulation should be measured directly at the terminal block for the purpose of the specification.

Mounting and ventilation The power supplies are provided with M3 threaded fixing holes in both faces of the 'L' shaped chassis. Fixing screws should not penetrate more than 5mm. Cooling is by natural convection and provision should be made to allow free air flow round the unit.

GUARANTEE & SERVICE

This power supply is guaranteed against defective components or faulty manufacture for a period of 12 months from the date of despatch from Farnell Instruments Ltd or an approved Agent.

We recommend that should it need repair it be returned to The Service Dept. of Farnell Instruments Ltd or an approved Agent.

CIRCUIT DESCRIPTION

The following is a simplified description of the N180 and N160R units and should be read with reference to the schematic diagram provided above.

The filtered mains input is connected to a switch-choke regulator which reduces the rectified input voltage to approximately 150V. This 150V rail powers a self-oscillating inverter which drives a transformer at about 22kHz. Secondary windings on this transformer provide different voltages for the various outputs which are individually rectified and filtered.

Feedback is taken from output 1, via an opto-isolator, to control the duty ratio of the switch-choke regulator transistor and stabilize output 1 by controlling the nominal 150V rail.

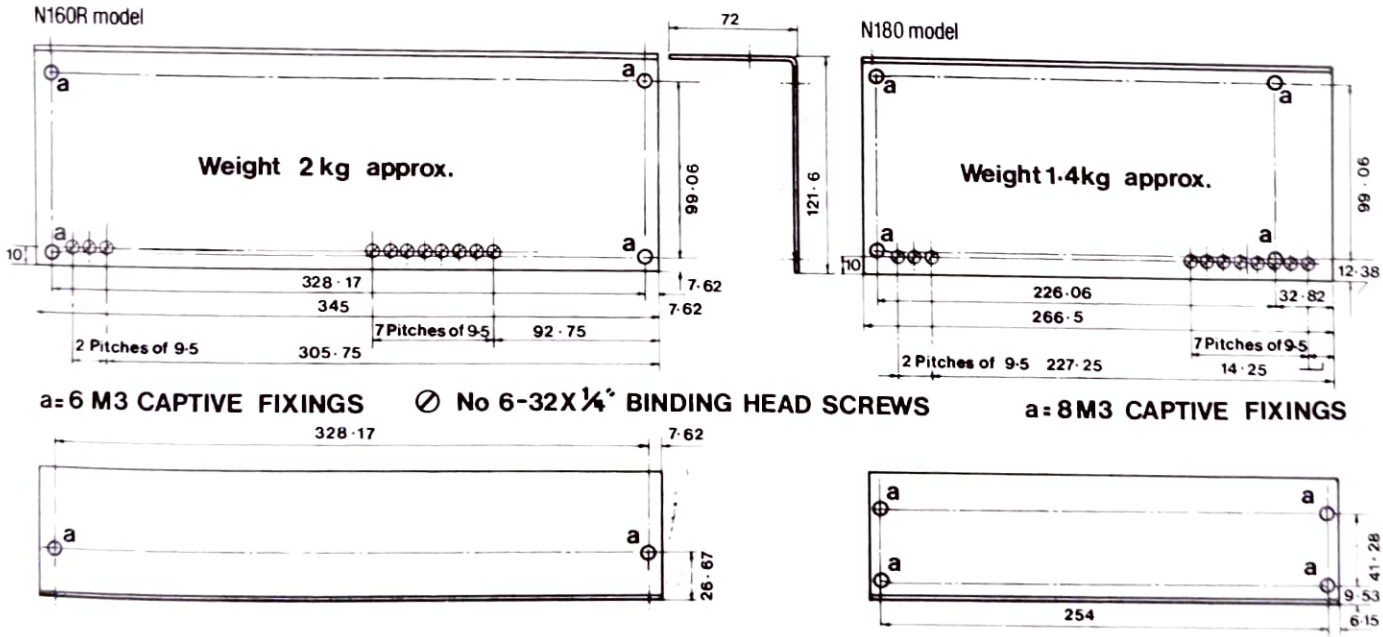
Extra windings on the inverter transformer synchronise the operation of the switch-choke regulator with the free-running inverter and provide drive to the triac which by-passes the input soft-start resistor.

Output 1 load current, via a current transformer, is sensed by a comparator and in the event of an overload the current is restricted by controlling the switch-choke regulator to reduce the 150V rail. Similarly an overall power-limit is provided by restricting the current drawn from the switch-choke regulator.

If an output overvoltage occurs the crowbar SCR is triggered, clamping output 2 and reducing the other output voltages by action of the power limit. The SCR remains in the triggered condition until the mains input supply is interrupted.

On the N180 unit a cross regulator circuit is connected to output 1 current sense transformer to reduce the voltage variation of outputs 2 to 5 when output 1 load changes. This is not necessary for the N160R unit since each output is individually stabilized and current limited by extra regulator cards. These are conventional linear regulators for low current outputs and switch-choke regulators for higher current. A low line inhibit circuit prevents the unit from supplying any output when the mains input is low and provides a suitable delay for the soft-start circuit.

MECHANICAL DETAILS



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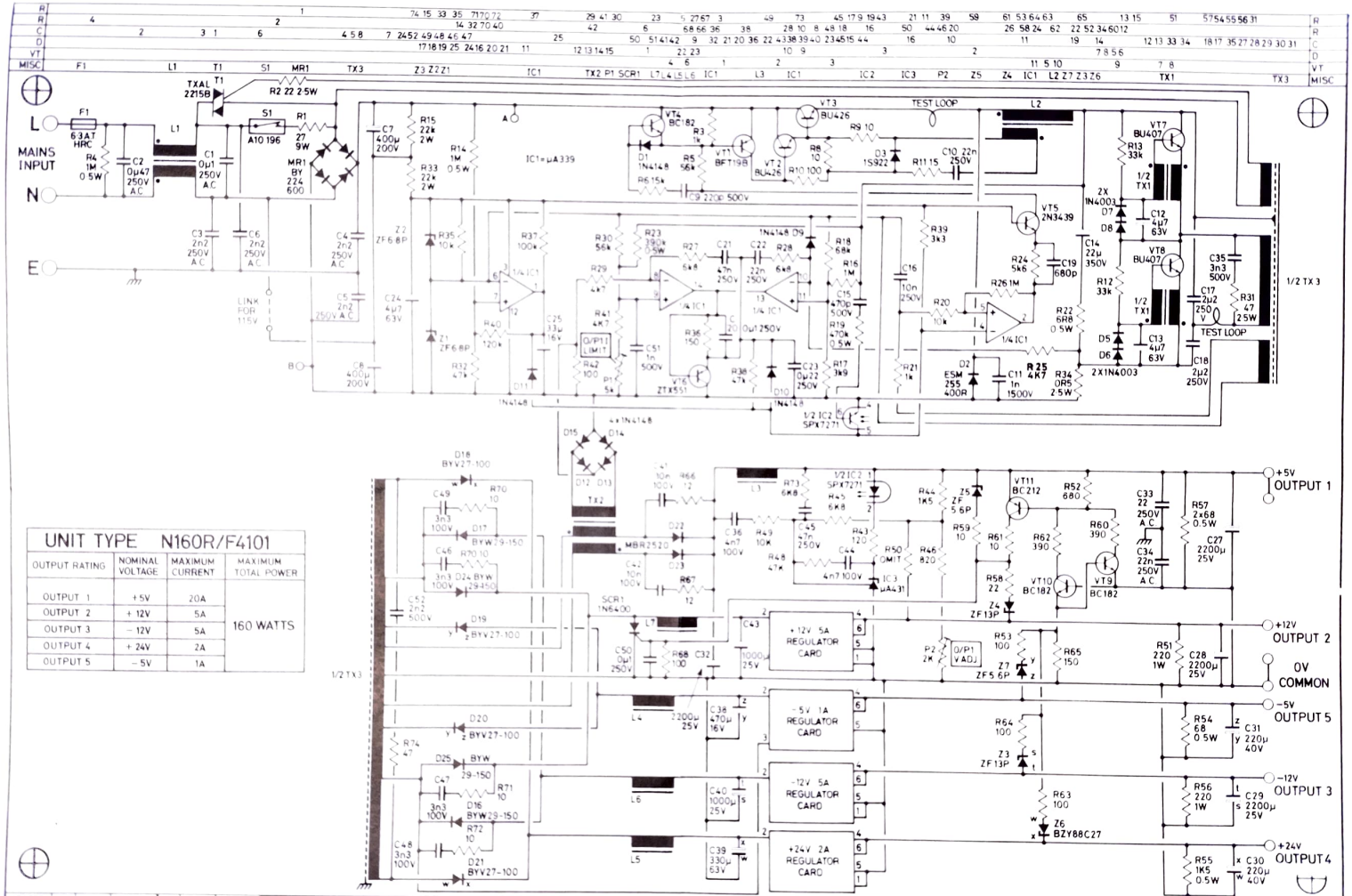

UNIT TYPE N160R/F4101			
OUTPUT RATING	NOMINAL VOLTAGE	MAXIMUM CURRENT	MAXIMUM TOTAL POWER
OUTPUT 1	+5V	20A	160 WATTS
OUTPUT 2	+12V	5A	
OUTPUT 3	−12V	5A	
OUTPUT 4	+24V	2A	
OUTPUT 5	−5V	1A	

ISS	DATE	MOD. NO.
A	13·3·81	

CHECKED K.D.
DRAWN S. MOORTEAM

WARNING

DANGEROUS VOLTAGES ARE PRESENT AT MANY POINTS ON THE CIRCUIT BOARDS.

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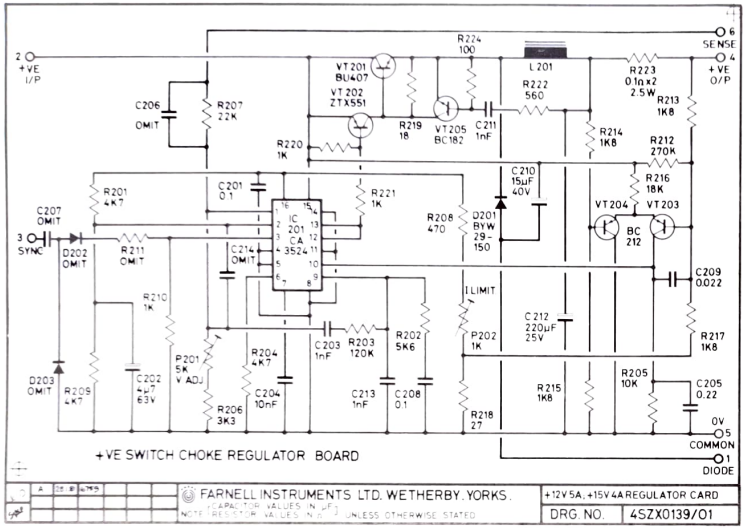
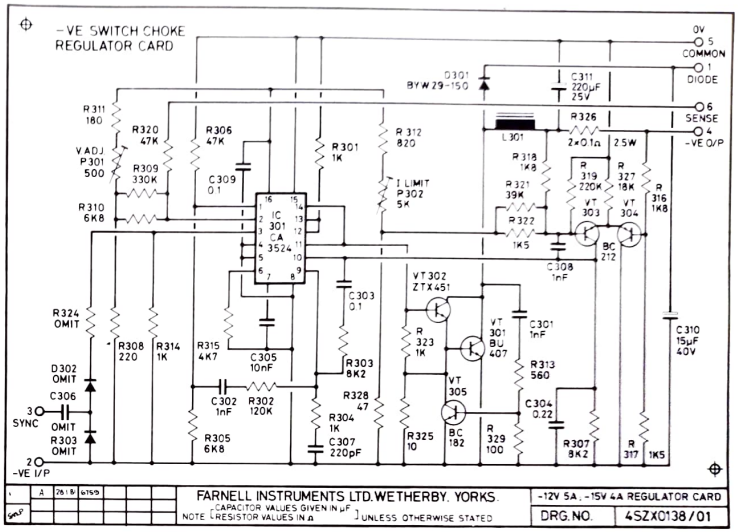
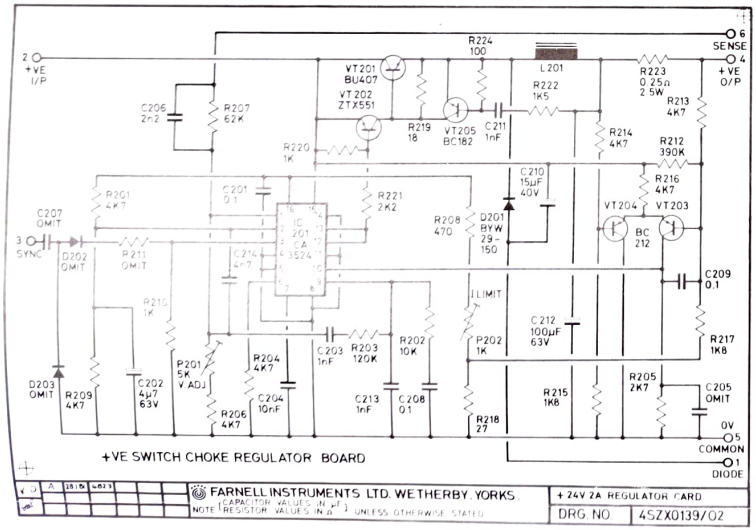
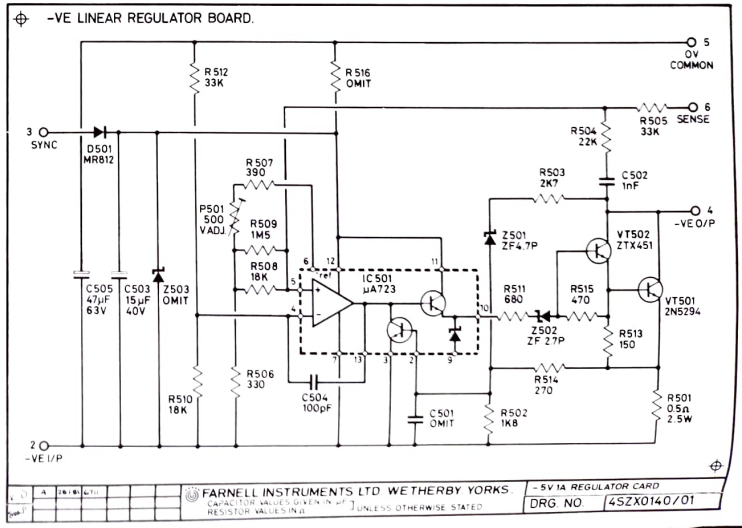
MOPS CIRCUIT DIAGRAM N160R/F4101

DRAWING NO. 2SZ0145/01


+VE SWITCH CHOKE REGULATOR BOARD
FARNELL INSTRUMENTS LTD. WETHERBY. YORKS.
+12V 5A, +15V 4A REGULATOR CARD
DRG. NO. 4SZX0139/01


-VE SWITCH CHOKE REGULATOR CARD
FARNELL INSTRUMENTS LTD. WETHERBY. YORKS.
-12V 5A, -15V 4A REGULATOR CARD
DRG. NO. 4SZX0138/01


+VE SWITCH CHOKE REGULATOR BOARD
FARNELL INSTRUMENTS LTD. WETHERBY. YORKS.
+24V 2A REGULATOR CARD
DRG. NO. 4SZX0139/02


-VE LINEAR REGULATOR BOARD.
FARNELL INSTRUMENTS LTD. WETHERBY. YORKS.
-5V 1A REGULATOR CARD
DRG. NO. 4SZX0140/01